Evaluation of the Impact of the Mother and Infant Health Project in Ukraine

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Abstract

This paper exploits a unique opportunity to evaluate the impact of the quality change in the labor and delivery services on maternal and infant health. Since basic medical care has been universally available in Ukraine, implementation of the Mother and Infant Health Project allows addressing quality rather than quantity effect of medical care. Employing program evaluation methods we find that the administrative units participating in the Project have exhibited greater improvements in both maternal and infant health compared to the control rayons. Among the infant health characteristics, the MIHP impact is most pronounced for stillbirths and infant mortality and morbidity resulted from deviations in perinatal period and congenital anomalies. As for the maternal health, the MIHP is the most effective at combating anemia, blood circulation, veins, and urinary-genital system complications, and late toxicosis. The analysis suggests that the effects are due to early attendance of antenatal clinics, lower share of C-sections, and greater share of normal deliveries. Preliminary cost-effectiveness analysis shows enormous benefit per dollar spent on the project: the cost to benefit ratio is one to 97 taking into account both maternal and infant lives saved as well as cost savings due to changes in labor and delivery practices.

1 Introduction

Infant mortality/morbidity has often been a focus of health economics and medical research as a major indicator of a country's well-being, while maternal health outcomes have been much less investigated. Several reasons are to be named for such a development. One is that the rates of maternal deaths are quite low in developed countries. And the second is attributed to the difficulty of measuring maternal health outcomes. Nevertheless, the issue of maternal health attracts considerable attention of society due to the fact that most of maternal deaths and health deteriorations are preventable. Moreover, recent evidence demonstrates that improvements in health outcomes for mothers and infants are related not as much to the availability of care (structural quality), but to the way this care is provided (process quality) (Barber and Gertler, 2002). Furthermore, some studies find that access to low quality providers in fact contributes to higher child morbidity and mortality (Sodemann et al., 1997).

Notwithstanding the importance of the matter, studies of the impact of quality of prenatal care and labor and delivery services on maternal and infant health outcomes are quite rare: it is difficult to find a setting that allows separation of quality from quantity dimension. This paper contributes to the literature analyzing the impact of exogenous change in the quality of prenatal care and labor and delivery services caused by the Mother and Infant Health Project (MIHP). Ukrainian setting creates a unique opportunity for an identification of this quality impact: (i) unlike the situation in developing countries (where health initiatives come together with new facilities), participation in the Project has changed only quality dimension of services, since the basic prenatal and obstetrics care is universally available; (ii) unlike the situation in developed countries (where population health compares favorably to the

rest of the world), the level of maternal and infant health outcomes is quite poor leaving enough room for improvement; (iii) every maternity regularly reports information on maternal and infant health outcomes to regional health administration. In addition, the study investigates the mechanisms through which reductions in infant and maternal mortality and morbidity take place via estimating the impact of the MIHP on prenatal care use, intermediate health outcomes, and mortality components.

Using difference-in-difference methodology it is found that the MIHP participating rayons observe greater improvements in maternal and infant health. The results indicate that improvements in maternal morbidity (lower prevalence of anemia, blood circulation system, veins, and urinary-genital complications) and mortality may be due to earlier attendance of prenatal clinics, increased rate of normal deliveries, and reduction in rate of C-sections. The same channels may be leading to improvements in infant health: the MIHP participation significantly reduces total infant mortality and stillbirths, as well as mortality and morbidity resulted from deviations in perinatal period and congenital anomalies.

The paper is structured as follows. The next section describes the system of health care in Ukraine, the Mother and Infant Health Project, and provides an overview of the related literature. Section three focuses on the empirical methodology followed by the descriptive analysis in Section four. Basic estimation results are offered in Section five. Section six follows with the robustness checks and discussion.

2 Background

2.1 Health Care System and Maternal Health Services in Ukraine

The right for free health care is one of the basic Constitutional rights in Ukraine (Article 49). And, although the informal payments are widespread (Allin, Davaki, and Mossialos, 2005), certain set of basic services can be rendered by patients for free, and this is most evident with respect to maternal and infant care. Majority of the health care establishments are publicly owned and are subordinated to regional administration. By the end of 2000, Ukraine has had more than 24 thousand of health care facilities, including various support units like medical statistical centers, medical treatment facilities, spas, health resorts, blood transfusion centers etc. At the same time only about six thousand individuals and about one thousand of legal entities have been licensed to practice medicine independently (Lekhan, Rudiy, and Nolte, 2004). According to the same source, only about 2% of the population has medical insurance, although this number has been growing with improvement of economic conditions up to year 2008. However, the trend is likely to reverse in the face of the current economic crisis. According to the Ministry of Health Report the overall health care financing in year 2007 comprised 3.9% of the GDP compared to the 3.3% in year 2006 (MHCU, 2007), which is considerably lower than in the EU and Eastern European countries (OECD average is 8.9).[1]

The network of reproductive facilities consists of maternities (approximately one per rayon[2]) and women's clinics (about 1-3 per rayon) as well

[1] OECD Health Data 2009, www.oecd.org/health/healthdata.

[2] Administratively, Ukraine consists of 25 large units - "oblast" - (including the Autonomous Republic Crimea), and 2 cities of the country subordination (Kyiv and Sevastopol). An oblast consists of about 13-46 small administrative units - "rayons". Rural units as well as small towns are subject to rayon governance, while big towns and cities are subordinated to oblasts.

as pediatric clinics. Women's clinics specialize in antenatal care including (i) monthly patronage of pregnant women, (ii) routine tests (blood, pressure, and urine) and measurements (weight and height), (iii) prevention of complications during pregnancy, and (iv) family planning counseling. Rayon maternities address delivery and postpartum issues, while oblast maternities focus on complicated labor and delivery cases (those with severe anemia, diseases of urinary-genital, blood circulation systems, etc.). Pediatric clinics provide regular infant care including vaccination and routine monitoring in the first year of life and thereafter as need arises.

2.2 Mother and Infant Health Project Description

The Mother and Infant Health Project (MIHP)[3] is an eight-year project advocating evidence-based medical practices aimed at improvement of women's reproductive and newborns' health. With funding from the USAID and private sources, and with the support from the Ministry of Health of Ukraine, the project is being implemented by the JSI Research and Training Institute. The first phase of the project has been initiated in September 2002 in four regions of Ukraine, but first four maternities have actually joined the Project in mid-December 2003. By the end of 2006 the Project expanded to 20 maternity hospitals in twelve pilot regions. Following the Millennium Development Goals for the country (MEU, 2005), the MIHP pioneers to introduce new evidence-based medicine (EBM) standards: partner deliveries; avoidance of unnecessary C-sections, amniotomies and episiotomies; use of free position during delivery; immediate skin-to-skin contact; early breastfeeding; and the rooming-in of mothers and newborns. In addition, the Project actively supports the provision of trainings on effective perinatal

[3] `http://www.mihp.com.ua/english/Home/homepage.html`

technologies for the staff of the MIHP maternities, development of "centers of excellence" that serve as models in training/education of the medical practitioners of the corresponding oblast, and organizing health awareness campaign on healthy lifestyles.

The MIHP also aims to reinforce liaisons with local governmental institutions. The Project works on integration of EBM standards into a package of perinatal practices throughout Ukraine. It also targets revision of the current curricula for medical universities and colleges in order to increase the evidence base of educational programs for medical students and health care providers.

The MIHP in Ukraine belongs to a family of maternal and infant health improving initiatives throughout the world and builds upon their experience, JSI MotherCare[4] (1998-2000) being the largest among them. However, the MIHP in Ukraine is unique both with respect to the institutional setting and to its scope and length. Most of the earlier projects implemented by the JSI have mainly focused on specific issues (e.g. pregnancy of adolescent girls in Uganda and Zambia, anemia in Malawi) and have been short-term (the longest have been two-year projects in Egypt, Pakistan, and Zambia). Studying the MIHP impact in Ukraine has three advantages: (i) evaluation of the change in the quality of services in a setting where the access to basic services has not changed, (ii) study of the dynamics in the effect of the MIHP participation over time, and (iii) study of the pathways through which the effect manifests itself by analyzing various final and intermediate outcomes.

[4] http://www.jsi.com/JSIInternet/Publications/women.cfm

2.3 Related Literature

Although it is obvious that the determinants of maternal and infant health are closely related, there are very few works where the issue of maternal and infant health is considered jointly (Winikoff, 1988; Conway and Kutinova, 2006). Moreover, most of the economic literature (both theoretical and empirical, likewise in developed and developing countries) focuses on infant health almost completely ignoring the issue of maternal health. Similar trend has been observed in the medical literature (AbouZahr, 2003). Two reasons are to be named for such a phenomena. One is that the rates of maternal death are quite low in developed countries. And the second is attributed to the difficulty of measuring maternal health outcomes, especially in developing countries. Nevertheless, even in the developed nations with their low maternal mortality ratios (which are 2-3 time lower than those in Ukraine) this issue draws considerable attention due to the fact that most of these rare deaths are preventable. Moreover, as Haas, Udvarhelyi, and Epstein (1993) claim "60 percent of women receive medical care for some complication of pregnancy and 30 percent suffer complications that result in serious morbidity" (as cited in Conway and Kutinova (2006)).

MIHP is a program that targets quality of labor and delivery services directly as well as quality of prenatal care indirectly, since most of the obstetricians in Ukraine have joint appointments in maternities and antenatal clinics. Therefore the expected impact of the MIHP can be inferred from earlier literature on impact of antenatal and obstetric care. Antenatal care can reduce maternal mortality and morbidity both directly, through detection and treatment of pregnancy-related or intercurrent illnesses, and indirectly, through detection of women at increased risk of complications of delivery and referring them to a suitably equipped facility (Oxaal and Baden, 1996).

Analysis of historical data shows that a significant fall in maternal mortality ratios in the UK and the USA can be attributed to improved obstetric care. In particular, Carroli, Rooney, and Villar (2001) emphasize that better delivery care significantly reduces maternal mortality from infections and hemorrhage. Laditka et al. (2005) in turn suggest that adequate prenatal care may reduce potentially avoidable maternity complications. However, other authors underline that the impact of prenatal care and/or certain interventions during pregnancy is more difficult to assess due to a large number of confounding factors not observed by researchers (Carroli, Rooney, and Villar, 2001). However, out of the socio-economic factors, only income has been identified as a significant determinant in reducing the probability of having a complication (Laditka et al., 2005). An institutional determinant of infant health outcomes that usually receives a lot of attention from researchers is health care spending. But empirical evidence from a cross-country study of developing countries suggests that the health care spending has no significant effect on child mortality while the access to health care and the mother and infant health programs do. The reason for the lack of effect of spending on mortality may be inexpensiveness of effective interventions so that "they do not even show up in data on ... public spending" (McGuire, 2006).

It is common in health economics research to find little or no effect of prenatal care on infant health, which may be due to two reasons - endogeneity and heterogeneity. Mothers anticipating poor birth outcomes are more likely to seek more prenatal care and seek it earlier while still having poorer than average outcomes. Authors that use exogenous variation in prenatal care, such as "natural experiment", find positive and significant impact of prenatal care use on birth outcomes (Evans and Lien, 2005). Conway and Deb (2005) in addition to addressing the issue of endogeneity explore the possible

heterogeneity in the impact of prenatal care on birth outcomes. Looking at all births simultaneously may obscure the effect of prenatal care on "normal" births. Some of the births result in poor outcomes due to bad maternal behavior or poor fetus condition to begin with and cannot be remedied by any prenatal care intervention. Therefore, lack of significant impact of prenatal care on infant health may be explained by data that do not distinguish between "normal" and "problematic" pregnancies. Thus, Conway and Deb (2005) find that prenatal care has a substantial effect on "normal" pregnancies.

Similarly, using individual level data, Bhalotra (2007) finds no effect of health care spending. However, when investigating separately the effect on poor and rural households, spending does play a role in improving infant health for those groups. Goldman and Grossman (1982) find that health care spending and public policy programs in the US do have a significant impact on infant mortality, and argue that this impact runs through improvements in health of mothers, rather than the use of prenatal care per se. The evidence also shows that infant and child mortality and morbidity are determined by poverty and unemployment rate (Bhalotra, 2007; Currie and Grogger, 2000), parental education, urban residence, and maternal health in general (Buckley, 2003; Chou et al., 2007).

Despite serious shortcomings , such as misclassification of deaths and difficulties with registering severe impairments related to pregnancies and births, but not resulting into death outcomes, most common measure used in the literature relying on statistical evidence is maternal mortality. With respect to infant health outcomes, in addition to various measures of infant mortality (e.g. perinatal, early and late neonatal, infant mortality etc.), birth weight and early onset of breastfeeding are also used, although the latter outcome

measure is less common.

Current study contributes to the literature in two ways: (i) by evaluating causal impact of quality of labor and delivery services, (ii) by studying a wide range of maternal and infant health outcomes simultaneously and (sketching the mechanism through which the MIHP impact manifests itself, and (iii) by decomposing the impact of the MIHP over time since the start of the project. The outcomes studied include those usually used in the literature, but also a wide range of morbidity outcomes related to various complications in both mothers and infants, and intermediate outcomes, such as a rate of C-sections and an early onset of prenatal care. However, for example birth weight is left beyond the scope of this study merely because the data set contains too many missing observations to allow for meaningful conclusions on that outcome. Concerning potential misreporting for infant health outcomes in the Soviet Union and the NIS countries documented in early studies (Brainerd, 2006; Anderson and Silver, 1986), it should not have an impact on the results as long as misreporting is unrelated to the treatment, which is very unlikely.

3 Empirical Strategy

The preliminary insider assessment of the Project shows positive trends in maternal and infant health outcomes in the participating maternities along various dimensions: use of individual delivery rooms, companion presence, level of C-sections and episiotomies, neonatal mortality and morbidity, etc. However, this insider monitoring does not allow identifying the real effect of the treatment for two reasons. One is that the Project may have a spillover effect on the neighboring community, in which case the insider assessment would give an underestimate of the true effect. The other reason is that ana-

lyzing the data at the site of treatment does not allow separating the effect of the Project from the changes in the outcome measures due to other confounding factors, in which case it would be an overestimate or underestimate of the true effect depending on the sign of the correlation between the confounding factors, the treatment variable, and the outcome.

Theoretically maternal and infant health (Conway and Kutinova, 2006) depends on health inputs, including such intermediate determinants as prenatal care and access to health services (McCarthy and Maine, 1992), mother and infant health endowments, and socio-economic characteristics (distant determinants). However, in the empirical specification we omit all of these variables to avoid over controlling.[5] The simplest estimator used to evaluate the effect of the MIHP participation (treatment effect) is a difference-in-difference estimator (DD) and the empirical model takes the following form:

$$H_{rt} = \beta_0 + \beta_P P_{rt} + T_t\beta_t + R_r\beta_R + T_tO\beta_{to} + \beta_X X_{rt} + u^0_{rt}, \qquad (1)$$

where health outcome H in region r at time period t depends on treatment P. Overtime changes in health outcomes are compared between the MIHP participating rayons and the control rayons netting out the common time trend T_t, rayon-specific fixed effects R_r, and oblast-specific time effect T_tO since all medical institutions are subordinated to and financed by oblast-level authorities. X_{rt} is a variable indicating whether other programs that may have an impact on maternal and infant health are being implemented in

[5]The analysis has also been performed including the full list of controls (total population morbidity, number of Chornobyl-related diseases, doctor's load, per capita number of obstetricians and midwives, share of deliveries to women aged 18-34, share of first deliveries, number of colleges and universities interacted with time, logarithm of real average wage, share of employed among working age population, per capita air pollution, ratio of divorces to marriages, population weighted number of families getting utility subsidies). However, none of these variables show statistical significance and do not alter in any meaningful way the estimates of the MIHP impact.

a rayon in a particular year [6]. It should be mentioned that these programs are rather different from the MIHP. Most of them are associated with significant financial contributions, provision of new expensive equipment, etc., while the MIHP emphasizes low cost of quality improvements. This makes it absolutely necessary to control for the effect of these other programs and attempts to compare it to the MIHP impact. In order to account for the remaining serial correlation, the standard errors are clustered at the rayon level (Kezdi, 2004; Stock and Watson, 2008).

In such a setting, the estimate of β_P for the treatment dummy (MIHP participating rayon) gives us the difference-in-difference (DD) estimate of the treatment effect of the MIHP participation. However, this estimate may be biased due to potential contamination of the control group. This contamination is quite likely since the MIHP sites are required to provide trainings to the personnel of all maternities of the oblast where the site is located. Thus, the model is augmented by a variable MIHP-oblast that could capture the impact of these trainings:

$$H_{rt} = \beta_0 + \beta_P P_{rt} + \beta_P^{tr} P_{rt}^{tr} + T_t\beta_t + R_r\beta_R + T_t O\beta_{to} + \beta_X X_{rt} + u_{rt}^0, \qquad (2)$$

In this case β_P^{tr} picks up the effect of trainings only and represents the lower bound of the MIHP impact.

The estimates of the MIHP impact discussed above provide the average treatment effect across all MIHP rayons compared to control rayons. However, this approach is subject to several limitations. First of all, it does

[6] These programs include Swiss Neonatal Program, Hospital to Hospital Program (The Ukraine 3000 Charitable Foundation), Cradle of Hope (Viktor Pinchuk Charitable Foundation). They involved considerable amounts of money primarily devoted to the purchases of new equipment. The full list of the programs, their timing, location, and funding is available from the authors upon request.

not allow for heterogeneity of treatment since various components of the Project may be implemented in stages. Second, it does not account for a possibility that the Project impact may depend on the duration of participation. Finally, it does not refute the possibility that the MIHP maternities are systematically different from the control group prior to the treatment and whether this difference has an impact on the validity of the Project impact estimates. To tackle these issues the MIHP indicator in Equation (1) is replaced with a set of variables reflecting the timing of the Project implementation: (T_{-3},T_{-2},T_{-1},T_1,T_2,T_3). All these variables are equal to zero for the control group outcomes and 1 for the treatment group at various stages of the Project implementation: three years before, two years before, one year before, one year after the Project start-up, two years after, three and more years after respectively.

However, there still exists a possibility that the resulting estimates may not reflect the true treatment effect, since the rayons could have experienced other health affecting initiatives implemented simultaneously with the MIHP. Thus, the estimated treatment effect of the MIHP would be upward-biased if other initiatives' influence on maternal and infant health outcomes is positive and downward-biased otherwise. Triple difference procedure is usually used in the literature to address this problem. However, it is impossible to directly apply it in the current setting since most of the outcomes used in the study are related to infants and females of fertile age only. Consequently, two alternative estimation procedures are utilized as tests for the validity of the DD strategy.

The first procedure applies the model described in Equation (1) to the pregnancy unrelated (placebo) outcomes (e.g. prevalence of diabetes, hepatitis, etc.). Lack of statistically significant health improving effect on these

outcomes would confirm the validity of the DD estimates of the MIHP impact on pregnancy related outcomes. The second procedure applies to an outcome which refers to the whole rayon population but can potentially be affected by the Project (e.g. hypertension). In this case it is possible to apply the DDD procedure with a slight modification of the suggested empirical model:

$$H_{rt} = \beta_0 + \beta_{PF} P_{rt} F_{rt} + \beta_P P_{rt} + \beta_F F_{rt} + Z_{rt}\beta_Z + \beta_{RF} R_r F_{rt} + \beta_{TF} T_t F_{rt} + \quad (3)$$

$$+\beta_{TR} T_t R_r + T_t \beta_t + R_r \beta_R + \beta_X X_{rt} + u^0_{rt},$$

where F_{rt} is the percentage of female population of fertile age. In this case the coefficient β_{PF} is the triple difference estimate of the MIHP treatment effect.

Outcome Variables. There are three groups of outcome variables to be evaluated: maternal, infant, and pregnancy-unrelated health outcomes (see Table 1). Bearing in mind difficulties that exist with the measurement of maternal mortality (Shiffman, 2000) stemming from the erroneous attribution of the cause of death, the emphasis in the current paper is put on the less arguable maternal health outcomes which can be plausibly attributed to changes in the quality of labor and delivery services. In addition, the MIHP impact on intermediate outcomes, such as early onset of prenatal care, rates of C-sections and normal deliveries is estimated.

Treatment Variables The treatment effect is represented by (i) dummy variable that takes the value of one for the MIHP-participating rayons (MIHP), (ii) dummy equal to one for all rayons of an oblast with at least one MIHP

rayon (MIHP-oblast), and (iii) a set of variables reflecting the time before and after the start-up of the Project in the treatment rayons.[7]

4 Data and Descriptive Analysis

Since all of the treatment rayons are urban, the analysis is constrained to urban rayons (i.e. those that have at least one town or city) resulting into an unbalanced sample of 13 treatment[8] and 227 control rayons. The data are obtained from the oblast Centers of Medical Statistics (CMS) which collect periodic administrative reports from all health care establishments on a routine basis. Existing gaps in the data, and therefore varying number of observations, do not reflect any systematic patterns, since they are mostly due to the difficulties of locating records at the CMSs, unrelated to the willingness of maternities to report certain types of outcomes.[9] The analysis covers the period from 2000 to 2006.[10]

The restriction of the sample only to urban rayons serves several purposes. First, it allows matching the treatment rayons to more comparable control rayons, since no rural rayons have participated in the MIHP. Second, rayons are more homogeneous compared to the larger administrative/geographic ar-

[7]Some of the rayons have more than one maternity, so the basic analysis has been performed with the dummy variable substituted by the percentage of rayon maternities participating in the MIHP in a particular year. No qualitative difference in the results has been observed. The results are available upon request.

[8]By the end of 2006 MHIP expanded to 20 maternity hospitals. However, the number of treatment rayons in our sample is limited to 13. Seven locations are excluded for the following reasons: (i) two maternities are located in the capital city of Kyiv and are excluded from the analysis since this is the largest and most developed city in Ukraine and it cannot be plausibly compared to the other cities in the regions; (ii) three maternities are in Donetsk city, which is represented by one unit since it is possible for women in the same city to use any one of these maternities; (iii) three locations are excluded since the medical data are poorly reported for them.

[9]They are also unrelated to the availability of care: neither new maternities opened nor old ones closed during the analysis period.

[10]Although the MIHP project started in September 2002, the first four maternities joined the MIHP on December 10, 2003. So, year 2003 is considered being the first year when the implementation of the Project started.

eas and therefore the aggregated statistics is more reliable. Third, rayons with urban settlements are large enough to make it less likely that the individuals living in the area would seek care outside the rayon.[11]

Sample Description. In the pre-treatment period the MIHP rayons are in general characterized by poorer population health outcomes. Table 2 provides summary statistics comparing the difference between MIHP and non-MIHP rayons in year 2000 (pre-treatment period) and year 2006. For many of the outcomes but a few there is no statistically significant difference between treatment and control rayons. Among those few outcomes that show significant difference in the pre-treatment period are normal deliveries, C-sections, late toxicosis, as well as complications related to the thyroid gland for maternal health, and stillbirths, infant mortality due to perinatal deviations, total infant morbidity, and infant morbidity due to congenital anomalies for infant health. However, for all these outcomes the non-MIHP rayons compare more favorably to the treatment rayons. This confirms that the selection into the MIHP is based on poor outcomes suggesting that the estimates of the MIHP impact should be considered as a lower bound since the selection on poorer pre-treatment outcomes leads to an underestimation of the treatment effect.

Despite the pessimistic pre-project health conditions, after the implementation of the MIHP the majority of the maternal and infant health outcomes have improved. Over the period from 2000 to 2006 a sharp decrease in maternal mortality (from 24 to 4 in the MIHP rayons) and a drastic decline of the full set of maternal morbidity indicators are observed. The rate of normal deliveries in the MIHP sites have increased twice, while in non-participating

[11] To test the last argument, a robustness check for the whole range of outcomes is performed on a set of rayons that consist of oblast-subordinated cities (metropolitan areas). Qualitatively results are similar, but quantitatively they are much stronger for metropolitan areas. The results are available upon request.

areas the increase of these indicators does not exceed 60%. The total infant mortality rate, which in 2000 exceeds the non-MHIP indicator by 2, has declined from about 14 to 9 cases per 1000 live births. The only outcome that has worsened is the percent of C-sections, for both MIHP and non-MIHP rayons, which is an unexpected result. However, these are only simple comparisons of means and they do not account for other factors that could have influenced the outcomes.

5 Estimation Results

Maternal Health. First part of Table 3 shows estimated impact of the MIHP on maternal health outcomes. The treatment variable is measured as an indicator equal to one for the MIHP participating rayons in all time periods after they joined the Project. Therefore, the estimated coefficient shows average treatment effect for all MIHP-participating rayons. As could be seen from column (1), the difference-in-difference estimate of the MIHP impact is health improving: women in the MIHP rayons are more likely to have normal deliveries and less likely to have C-sections. With respect to complications, mothers in the MIHP-participating rayons are less likely to experience anemia, problems with the blood circulation system, veins, as well as late toxicosis.

Potential problem with the estimate of the MIHP effect would have arisen in case if the MIHP maternities after joining the Project would have started selecting less complicated pregnancies, ensuring better outcomes simply by the composition of the patients. However, as evidence suggests, most of the MIHP maternities have been so called oblast maternity centers, which are designated to deal with high risk pregnancies and therefore are legally

obliged to admit all high risk referrals from the surrounding areas.

Infant Health. As could be seen from the lower part of Table 3, the MIHP impact on infant mortality and stillbirths is negative and statistically significant. The evidence suggests that most of this effect is contributed by the impact of the MIHP on infant mortality due to deviations in perinatal period and congenital anomalies. The lower part of the table presents the estimates of the MIHP impact on infant morbidity. No significant treatment effect is found for total infant morbidity. However, infant morbidity due to deviations in perinatal period has decreased faster in the treated rayons. The effect is quite large in magnitude - average treatment effect is a 16 percent decline compared to the baseline value of the outcome (-0.51 reduction from 3.25 diseases per 100 infants in year 2000).

6 Robustness Checks and Discussion

To address various concerns related to the contamination of the control group and causality of the MIHP impact, three variations to the basic specification have been pursued: (i) accounting for the trainings provided to the medical personnel of the same oblast, (ii) exploration of the MIHP impact over time, including pre-MIHP period, and (iii) estimation of the MIHP impact on pregnancy unrelated (placebo) outcomes including triple difference procedure.

Effect of MIHP Trainings. Columns (3) through (5) in Table 3 show the estimates from the maternal and infant health regressions including the spillover effect on the same oblast maternities which can be interpreted as the effect of the MIHP trainings, the lower bound of the overall MIHP impact. As

could be seen, the MIHP impact in Column (3) becomes stronger what is expected in the case of addressing the issue of contamination of the control group. For some outcomes (maternal mortality, normal deliveries, and anemia) there exists a significant effect of the MIHP trainings, although it is about twice smaller in magnitude for normal deliveries and anemia, than the direct MIHP impact. At the same time even the direct MIHP effects on total infant mortality and stillbirths become statistically insignificant.

MIHP Effect Over Time. As Tables 4-5 show in most cases there is no significant difference between treatment and control rayons in the years prior to the Project implementation. This points to the causality of the MIHP impact with respect to most of maternal and infant health outcomes.

Another dimension that the reported estimates uncover is the dependence of the MIHP impact on time. For example, share of normal deliveries increases in the year of the Project start-up, the increase is even more pronounced in the year after and vanishes after that. The situation is different for anemia prevalence - the positive effect is becoming stronger over time.[12]

MIHP Effect on Placebo Outcomes. Table 6 presents the estimates of the MIHP impact on placebo outcomes. As the estimates show, no statistically significant effect is observed for the number of diagnosed cases of hepatitis and diabetes. There is a significant positive effect for hypertension and teenage morbidity, pointing to certain changes in the treated rayons that have occurred at the same time with the Project and had health deteriorating effects. This means that the current MIHP impact estimates could in fact

[12]The same estimation procedure has been applied to a sample restricted to metropolitan areas. This procedure allows checking the robustness of the average treatment effect estimates as smaller cities included in the main sample may be more heterogeneous in terms of the health outcomes and socio-economic background. As the estimation results reveal there is almost no difference in the qualitative results, but the point estimates are much larger in magnitude.

underestimate the true impact.

Since sometimes the onset of the diabetes and hypertension may be related to pregnancies, a triple difference estimation has been performed following the specification in Equation (3). As the DDD results show, a significant negative impact of the MIHP participation is observed for the onset of the hypertension. Unfortunately, the data do not allow to use the same methodology for the teenage morbidity.

7 Cost-Benefit Considerations

A comprehensive cost-benefit analysis of the MIHP project is limited, since the majority of maternal and infant health indicators are hard to assess in monetary terms (e.g. increase in early neonatal visits of mothers; decrease in the number of cases of late toxicosis and complicated deliveries; decrease in infant morbidity due to various reasons etc.). Therefore, we focus on the most "tangible" cost effectiveness indicators and compare (i) average annual per maternity cost of the Project and (ii) average annual per maternity "tangible" benefits.

The average annual per maternity cost is about 60,000 USD, and it is calculated as an overall cost of the first phase of the project - 6 mln USD - distributed over 20 treatment sites during 2002-2006 when the first MHIP phase was implemented, including the first year of the Project setup. Set of "tangible" benefits includes savings due to (i) a switch from C-sections to vaginal deliveries, (ii) switch away from medicine-intensive ways of leading both C-sections and vaginal deliveries, and (iii) saved lives of mothers and infants due to the implementation of the MIHP practices. Table 7 provides a summary of the benefits calculation. The estimates of the impact are taken

from the preferred specification in Table 3, Column (3).

One of the major findings from the current analysis is that the number of C-sections in the MIHP participating rayons decreases by 4.85% or by 136.10 deliveries on average per year. The difference in the average cost between vaginal deliveries and C-sections is 92.35 UAH per patient[13]. Hence, the aggregated savings from a "C-section towards vaginal deliveries switch" is 12,568.90 UAH (92.35 UAH times 136.10 patients), which is equivalent to 2,488.89 USD.

Switch away from medicine-intensive ways of leading both C-sections and vaginal deliveries is associated with considerable savings which are achieved through a reduction in expenditures on tests, exams, and medicines during labor and postpartum periods. According to the MIHP team's analysis, the implementation of the MIHP technologies has significantly reduced the cost of both vaginal deliveries and C-sections. If the post-treatment year of 2005 is compared to the pre-treatment 2002, per patient cost of vaginal deliveries has dropped by 107.30 UAH, while per patient cost of C-sections has declined by 149.35 UAH. Since the average number of vaginal deliveries in 2005 is 2,464.69 and the average number of C-sections is 341.51, the aggregated savings total to 315,465.95 UAH that is equivalent to 62468.50 USD. Together with the cost savings due to a switch away from C-sections this brings 64,957.40 USD savings per year.

The reduction in maternal and infant mortality can be taken as a final measure of the effectiveness of the Project. The estimates suggest that the MIHP participation on average translates into 1.69 fewer maternal deaths

[13]The average per patient cost of C-sections and vaginal deliveries has been calculated by the MIHP project team (for further details see Appendix). Per patient here combines both cost for a mother and a newborn. The cost survey has been conducted in three MIHP participating maternities in years 2002 and 2005. In the current cost-benefit calculation the average cost per delivery as estimated from these three maternities is taken as an average per delivery cost for all participating rayons.

per maternity per year and 5.63 fewer infant deaths resulted from deviations in perinatal period.[14] The estimates of the value of statistical life (VSL) do not exist in Ukraine. However, evaluated at the conservative estimate of a VSL from the literature (Giergiczny (2008) reports 0.79 mln USD for Poland, country most similar to Ukraine, with existing estimates of the VSL), this would result in a tremendous benefits of 5.8 mln USD for the country, well surpassing the cost of the Project.

So overall, the project costs to benefits ratio is 1 to 97 (60 to 5,847 thousand USD) if one takes into account value of lives saved and it is 1 to 1.08 (60 to 65 thousand USD) if one considers only costs savings due to change in C-section and vaginal delivery practices and switch away from C-sections to vaginal deliveries. The latter represents the lowest bound of the Project's benefits, since it does not take into account any health-improving impact of the MIHP. Although the range is quite wide and this preliminary calculation suffers from several limitations, it seems unlikely that given the estimated impact the true costs would exceed the true benefits.

8 Conclusion

Exploiting a unique opportunity provided by the Mother and Infant Health Project in Ukraine this paper evaluates the impact of the improvement in the quality of labor and delivery services on maternal and infant mortality and morbidity. This has become possible for two reasons. First is that the maternal and infant health outcomes are lagging behind those in Europe, thus

[14] According to estimates from the preferred specification from Table 3, the estimated MIHP impact on maternal mortality is 63 per 100,000 live births. Evaluated at the average number of live births in a participating maternity in year 2005 - 2681,4 live births - this translates into 1.69 fewer maternal deaths. Similarly, 21 newborns saved per 10,000 live births translates into 5.63 fewer infant deaths per maternity per year.

allowing the identification of the effect of health-related interventions. Second, and the most important, is that the labor delivery services and prenatal care are universally available in Ukraine. So, the estimation of the effect of the MIHP can be interpreted as an impact of the improvement in the quality of services, which is a rare opportunity in the research.

Employing program evaluation methods it is found that the urban administrative units (rayons) participating in the Project have exhibited greater improvement in both maternal and infant health compared to the control rayons. At the same time no effect has been found on the pregnancy unrelated outcomes, such as diabetes, hepatitis, and teenage morbidity, indicating the causality of the MIHP impact. The MIHP impact is most pronounced for infant mortality and morbidity resulting from deviations in perinatal period and congenital anomalies and maternal mortality and morbidity related to late toxicosis, anemia, veins, and blood circulation system complications. The analysis suggests that the effect stems from the early attendance of antenatal clinics, lower share of C-sections, and greater share of normal deliveries.

Decomposition of the MIHP impact over time supports the causality of the main finding, since no effect has been found in the pre-Project period. At the same for such outcomes, as anemia, share of C-sections and normal deliveries, and most of the infant health outcomes, the Project impact depends on time: it is small in the first year but increases in the second.

Interestingly, the MIHP implied very little monetary intervention - all of the provided equipment has been low cost, but most of the change has occurred through trainings of the personnel and changes in their attitudes and practices. The maternities participating in the Project have become more mothers' and family friendly, practicing active partner participation in the process of labor and delivery, less involvement of medicines, and joint

mother-baby accommodation. As a result, even after controlling for the overall trend in the country and oblast-specific time trend, the rayons with the MIHP-participating maternities do observe better maternal and infant health outcomes. And the impact is more significant statistically and economically for the outcomes directly related to the quality of labor and delivery services: decrease in infant morbidity and mortality due to deviations in the perinatal period and congenital anomalies, maternal mortality and various complications experienced by mothers during pregnancy, labor and delivery and in postpartum period. It can also be attributed to the indirect impact of the MIHP on the quality of prenatal care since most of the doctors employed by maternities have dual appointments at the antenatal clinics.

As the preliminary cost-benefit calculation shows, the Mother and Infant Health Project seems to be associated with a tremendous return to the country. The project costs to benefits ratio is 1 to 97 (60 to 5,847 thousand USD) if one takes into account value of lives saved and it is 1 to 1.08 (60 to 65 thousand USD) if one considers only costs savings due to changes in C-section and vaginal delivery practices and a switch away from C-sections to vaginal deliveries. Even though these cost-benefit considerations are quite rough, they indicate that the benefits of the MIHP are much higher than the costs.

This study provides evidence on the effectiveness of a low-cost change in the quality of the provision of labor and delivery services. Although this evaluation is not without a fault, especially with respect to its ability to separate the impact of various components of the Project, it provides some guidelines to be used in the development of future interventions. At the same time one should be cautious when considering the institutional setting in which the MIHP has worked. First of all, Ukraine has a well-qualified

health care labor force: well trained doctors and nurses in all parts of the country have regularly scheduled courses to upgrade their knowledge and exams that follow them. Second, Ukraine has a well educated population with 24% of women and 17% of men having high education (Ganguli and Terrell, 2006). These two factors alone may be a sufficient explanation of why an inexpensive change in the quality of services has been so successful in Ukraine, and may prevent policy makers from direct implementation of the Project in less developed countries. However, successful adoption of some of the components, such as warm chain practices and presence of a partner in the delivery room, may not require high skills of the personnel and well educated mothers to be successfully adopted.

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Table 1: List of Analyzed Health Outcomes

Maternal Health Outcomes	**Infant Health Outcomes**
Normal Deliveries per 100 deliveries	Stillbirths per 1,000 Newborns
C-sections per 100 deliveries	Infant Mortality per 1,000 Live births
Maternal Mortality per 100,000 live births	Infant Mortality per 10,000 Live births related to:
Per Cent of Pregnant Visited Antenatal Clinics before 12 weeks	Congenital Anomalies
Late Toxicosis per 100 Pregnancies	Perinatal Deviations
Deliveries Complications per 1,000 deliveries	
includig those related to:	Total Infant Morbidity per 100 Infants
Urinary-Genital System	including those related to:
Anemia	Congenital Anomalies
Blood Circulation	Perinatal Deviations
Veins Complications	
Thyroid Gland Complications	
Pregnancy and MIHP -unrelated Health Outcomes	
Tuberculosis Diagnosed per year per 100,000 Population	
Diabetis Diagnosed per 100,000 Population	
Hypertension per 100 adults	
Teenage Morbidity per 1,000 teenagers	

Table 2: Descriptive Statistics: Maternal Health and Infant Health Outcomes

	2000		2006	
	MIHP	Non-MIHP	MIHP	Non-MIHP
Maternal Health				
Maternal Mortality	24.21	34.50	4.84	13.12
	(26.31)	(95.27)	(10.71)	(55.24)
Normal Deliveries	27.88*	36.64*	59.56	55.70
	(12.35)	(15.93)	(15.23)	(14.69)
C-sections	12.49***	7.65***	14.27***	10.97***
	(5.96)	(4.00)	(3.62)	(4.44)
Early Neonatal Visits	81.51	80.76	89.89	89.13
	(10.10)	(9.08)	(8.35)	(6.45)
Late Toxicosis	12.24**	8.55**	7.38	7.00
	(5.23)	(5.43)	(3.14)	(4.33)
Complicated Deliveries by Cause:				
Urinary-Genital System	8.25	7.16	8.40	7.34
	(4.61)	(8.12)	(5.73)	(6.91)
Anemia	25.31	28.48	12.42**	24.24**
	(14.60)	(18.83)	(5.07)	(21.13)
Blood Circulation	4.20	5.28	2.86	3.76
	(4.39)	(8.62)	(3.05)	(5.00)
Veins	2.90	2.04	1.83	2.00
	(1.97)	(2.28)	(1.25)	(1.92)
Thyroid Gland	17.22**	8.86**	10.08	8.84
	(25.26)	(12.46)	(9.39)	(11.85)
Infant Health				
Stillbirths	6.69**	4.16**	5.21	4.84
	(4.11)	(3.30)	(2.81)	(3.59)
Infant Mortality Total	13.75	11.14	9.18	10.45
	(4.47)	(5.76)	(3.76)	(5.49)
By Cause:				
Congenital Anomalies	39.70	31.57	26.02	25.09
	(12.38)	(34.65)	(13.89)	(25.58)
Perinatal Deviations	53.54**	28.91**	40.26	37.95
	(38.20)	(32.70)	(27.17)	(33.68)
Infant Morbidity Total	242.10**	200.60**	228.59***	174.93***
	(88.37)	(69.41)	(100.15)	(63.62)
By Cause:				
Congenital Anomalies	0.70*	0.47*	0.54*	0.39*
	(0.53)	(0.40)	(0.29)	(0.27)
Perinatal Deviations	3.65	3.23	1.81	2.30
	(1.75)	(2.06)	(1.51)	(1.37)
Observations	12	13	194	227

Notes: (1) Standard errors in parenthesis. (2) Stars indicate significance level of the difference between MIHP and non-MIHP rayons in a particular year (* significant at 5% level, ** significant at 1% level).

Table 3: Estimated Impact of the MIHP

	MIHP	Other Programs	MIHP rayon	MIHP oblast	Other Programs
	(1)	(2)	(3)	(4)	(5)
Maternal Health					
Maternal Mortality	-7.10	-0.60	-63.06*	-58.45*	-2.11
	(9.24)	(16.95)	(34.02)	(33.73)	(17.08)
Normal Deliveries	10.12***	0.04	18.79***	9.06**	0.28
	(2.06)	(3.73)	(4.79)	(4.15)	(3.69)
C-sections	-2.48***	0.75	-4.85***	-2.48	0.69
	(0.70)	(1.07)	(1.75)	(1.56)	(1.05)
Early Neonatal Visits	2.09**	-0.11	2.89*	0.83	-0.08
	(0.85)	(1.08)	(1.58)	(1.54)	(1.08)
Late Toxicosis	-1.92**	-1.73	-2.87**	-1.00	-1.76
	(0.80)	(1.37)	(1.19)	(1.10)	(1.37)
Complicated Deliveries by Cause:					
Urinary-Genital System	-1.82	-0.44	-4.38**	-2.67	-0.51
	(2.01)	(1.41)	(2.02)	(1.95)	(1.44)
Anemia	-5.02***	-5.05**	-11.27***	-6.53*	-5.22**
	(1.86)	(2.54)	(3.69)	(3.62)	(2.54)
Blood Circulation	-1.39**	-0.45	-2.19*	-0.84	-0.47
	(0.57)	(0.72)	(1.17)	(1.04)	(0.71)
Veins	-0.54**	-0.26	-0.60	-0.06	-0.26
	(0.24)	(0.33)	(0.76)	(0.75)	(0.33)
Thyroid Gland	-0.96	-0.60	-4.34	-3.53	-0.69
	(1.41)	(1.66)	(4.84)	(4.80)	(1.66)
Infant Health					
Stillbirths	-1.58***	-0.20	-1.01	0.59	-0.18
	(0.54)	(0.67)	(1.61)	(1.61)	(0.67)
Infant Mortality Total	-3.13***	-2.12	-2.99	0.15	-2.12
	(0.90)	(1.55)	(2.48)	(2.55)	(1.56)
By Cause:					
Congenital Anomalies	-8.12*	-0.46	-21.15	-13.60	-0.81
	(4.27)	(6.12)	(19.89)	(20.05)	(6.11)
Perinatal Deviations	-14.10***	-9.62	-20.64**	-6.83	-9.80
	(5.22)	(8.63)	(9.53)	(9.49)	(8.65)
Infant Morbidity Total	-1.71	-0.46	-35.57	-35.36	-1.37
	(8.57)	(11.74)	(43.54)	(43.47)	(11.77)
By Cause:					
Congenital Anomalies	-0.03	-0.10	-0.10	-0.07	-0.10
	(0.04)	(0.11)	(0.08)	(0.08)	(0.11)
Perinatal Deviations	-0.53**	0.53	0.06	0.61	0.55
	(0.21)	(0.43)	(0.45)	(0.45)	(0.43)
Observations	1612		1612		
Number of Rayons	244		244		

Notes: Standard errors in parenthesis.

Table 4: Estimated Impact of the MIHP: Time Dimension

	Before			After			MIHP	Other
Outcomes	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Maternal Mortality	-16.78	8.83	15.09	-38.38	-60.26	-49.09	-43.35	-0.06
	(18.20)	(14.47)	(14.94)	(37.94)	(39.84)	(41.23)	(36.11)	(16.72)
Normal Deliveries	-0.56	-1.62	2.29	21.03***	23.42***	15.66***	11.18**	0.42
	(2.60)	(2.37)	(2.98)	(6.43)	(5.53)	(5.88)	(4.61)	(3.64)
C-sections	0.73	0.87	-1.06	-5.78***	-6.57***	-6.05**	-3.91**	0.69
	(1.04)	(0.85)	(0.73)	(2.21)	(2.00)	(2.44)	(1.66)	(1.06)
Early Neonatal Visits	-0.90	-0.22	-0.56	2.94	1.47	-0.09	0.25	0.11
	(0.89)	(1.09)	(1.00)	(1.97)	(2.08)	(2.34)	(1.70)	(1.08)
Late Toxicosis	-1.25	-1.54	-2.18*	-5.04**	-5.67***	-6.23**	-2.50*	-1.67
	(1.20)	(1.30)	(1.17)	(2.05)	(2.09)	(2.84)	(1.34)	(1.42)
Complicated Deliveries by cause:								
Urinary-Genital System	2.29	1.22	1.18	-2.09	-4.39	-5.41	-2.78	-0.33
	(2.66)	(1.58)	(1.70)	(2.72)	(3.61)	(6.01)	(2.39)	(1.60)
Anemia	-7.33	-7.25	-10.34*	-21.65***	-24.72***	-25.55***	-13.13**	-4.84*
	(4.67)	(4.54)	(5.65)	(7.84)	(7.39)	(8.11)	(5.45)	(2.63)
Blood Circulation	-0.11	0.76	-1.52**	-3.78**	-4.12***	-3.97**	-2.46**	-0.49
	(0.94)	(1.09)	(0.72)	(1.60)	(1.50)	(1.71)	(1.24)	(0.71)
Veins	0.14	-0.06	-0.18	-0.46	-1.28	-1.60	-0.37	-0.19
	(0.38)	(0.32)	(0.36)	(0.89)	(0.92)	(0.99)	(0.80)	(0.31)
Thyroid Gland	-3.76*	-0.90	-0.99	-3.65	-8.80	-6.09	-3.58	-0.25
	(2.21)	(1.76)	(1.55)	(4.55)	(5.55)	(5.24)	(4.65)	(1.87)
Observations	1612							
Number of Rayons	244							

Table 5: Estimated Impact of the MIHP: Time Dimension (cont.)

	Before			After			MIHP	Other
Outcomes	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stillbirths	-0.08	0.04	-0.46	-1.32	-1.94	-1.50	0.15	-0.15
	(0.81)	(0.87)	(0.81)	(1.87)	(1.90)	(2.11)	(1.71)	(0.68)
Infant Mortality Total	0.68	-1.90*	-2.24*	-4.69	-7.22**	-5.04	-1.70	-1.99
	(1.11)	(1.03)	(1.31)	(2.93)	(3.07)	(3.39)	(2.80)	(1.52)
By Cause:								
Congenital Anomalies	5.64	-2.61	-2.78	-23.23	-27.73	-18.67	-16.50	-0.85
	(6.98)	(5.84)	(6.27)	(21.22)	(21.24)	(22.15)	(20.75)	(5.63)
Perinatal Deviations	-1.13	-7.49	-11.52**	-33.11***	-35.31**	-30.69*	-15.35	-9.83
	(6.27)	(5.63)	(5.85)	(12.00)	(13.71)	(15.80)	(10.82)	(8.28)
Infant Morbidity Total	-5.62	5.22	-6.09	-38.13	-47.38	-57.34	-43.13	-0.34
	(12.88)	(10.41)	(9.82)	(46.18)	(45.91)	(46.31)	(44.06)	(12.08)
By Cause:								
Congenital Anomalies	0.01	0.07	0.05	-0.04	-0.07	-0.05	-0.05	-0.10
	(0.09)	(0.08)	(0.10)	(0.15)	(0.15)	(0.16)	(0.11)	(0.11)
Perinatal Deviations	-0.07	-0.37	-0.63**	-0.71	-0.54	-0.56	0.14	0.53
	(0.26)	(0.26)	(0.26)	(0.56)	(0.58)	(0.64)	(0.49)	(0.42)
Observations	1612							
Number of Rayons	244							

Table 6: Estimated Impact of the MIHP on Placebo Outcomes

	DD			DDD		
	MIHP rayon	MIHP oblast	Other Programs	MIHP rayon	MIHP oblast	Other Programs
	(1)	(3)	(5)	(2)	(4)	(6)
Tuberculosis Morbidity	-5.07	0.39	2.44	-1.08	-0.32	3.63
	(4.32)	(4.15)	(4.45)	(0.67)	(0.33)	(4.00)
Diabetis Morbidity	3.66	0.10	-12.81	-0.08	-1.41*	-11.69
	(18.82)	(18.48)	(14.44)	(1.50)	(0.76)	(18.64)
Hepatitis	1.12*	1.13*	-9.79	-3.42	1.07	-10.83
	(0.62)	(0.64)	(14.66)	(3.35)	(1.16)	(14.11)
Hypertension	-0.20	-0.73	-0.25	-0.09**	0.05***	-0.18
	(0.56)	(0.64)	(0.29)	(0.05)	(0.02)	(0.29)
Teenage Morbidity	0.24***	0.21***	-0.03			
	(0.08)	(0.08)	(0.04)			
Number of Rayons	244			243		
Observations	1612			1497		

Table 7: Per Mother and Child Cost Savings Calculation

	C-section (CS)	Vaginal delivery (VD)	CS-VD	
Post-MIHP cost 2005, UAH	118.40	26.05	92.35	
Average number of deliveries in 2005				2,806.20
Estimated impact on CS, percent				-4.85
Number of VD that would have been CS without the MIHP				136.10
Cost Savings Due to a Switch from CS to VD				**12,568.90**
Pre-MIHP cost 2002, UAH	267.75	133.35	134.40	
Post-MIHP cost 2005, UAH	118.40	26.05	92.35	
2002 to 2005 change in cost, UAH	149.35	107.30		
Average number of deliveries in 2005	341.51	2,464.69		
Cost savings due to a change in technology	**51,005.20**	**264,460.75**		**315,465.95**
Total, UAH				**328,034.85**
Total, USD				**64,957.40**
Average number of live births in 2005, MIHP sites				**2,681.40**
Mothers' lives saved per year (63 per 100,000 livebirths)				1.69
Newborns' lives saved per year (21 per 10,000 livebirths)				5.63
Total value of saved lives (VSL=0.79 mln USD)				**5,782,975.38**
Total Benefits (including saved lives)				**5,847,932.78**

Notes: (1) The cost includes the cost of the procedure for both mother and newborn. (2) The cost is given in 2005 prices. (3) Exchange rate for year 2005 is 5.05 UAH/USD. (3) Average number of deliveries and live births per rayon is calculated for all participating rayons in year 2005.

APPENDIX

Description of the Cost Impact Study implemented by the MIHP (Lefevre-Cholay et al., 2006)

The Cost Impact Study (CIS) was designed to evaluate the financial impact of the MIHP interventions in the Project pilot maternities and to provide health facilities and policy makers with information for replication of MIHP practices.

The Project management team has selected three MIHP facilities: Lutsk, Kovel, and Donetsk No. 3.There were two criteria for selection. First, the annual number of deliveries is to exceed 1,000 cases. Second, the maternities are to be involved with the project since 2003.

For the purpose of CIS, the project management team has collected the data using the following tools: the Patient Record Review Form, the Prices and Supply Costs Form, and the Interview Guide.

The Patient Record Review Form was randomly offered to patients who gave birth in the target facilities. A total of 200 records were reviewed in each facility - 100 from 2002 and other 100 selected in 2005. The Form covered topics such as admission and discharge time, type of delivery, types of lab tests performed and medicines used, as well as other information helpful for comparing delivery-related practices before and after MIHP interventions.

The Prices and Supply Costs Form was aimed at quantifying the resources used for MIHP practices, which were revealed via the Patient Record Review Form. The types of resources included drugs, injection supplies, lab tests and diagnostic procedures, and infant formula. Initially, the study design involved collecting prices of each resource from the facility pharmacies and local pharmacies, and calculating an average price. However, this data was extremely sensitive to local market imbalances. Thus, eventually it was decided to use the "standard prices" based on the lowest wholesale offers found in the national electronic trading system (www.apteka.com.ua). Unit prices were collected solely from 2005. This allows the

analysis to isolate the changes in costs due to changes in practices and resources used as opposed to changes in prices.

The Interview of the facility staff was conducted to corroborate the use of practices, drugs and supplies listed in the Patient Record Review Forms. It was also aimed to reveal under-reporting, over-reporting, miss-reporting, and unexpecte4d practices that arose during the record review process. A total of 3 senior obstetrics-gynecologists, 3 midwives, and 3 neonatologists at the three MIHP pilot facilities were interviewed.